ISSN: 2348-2079

International Journal of Intellectual Advancements and Research in Engineering Computations (IJIAREC)

IJIAREC |Vol.13 | Issue 2 | Apr - Jun -2025

www.ijiarec.com

DOI : https://doi.org/10.61096/ijiarec.v13.iss2.2025.22-34

Research

Hotel Revenue Management Dashboard Using Data Visualization And Streamlit

Gokul P*, Ms. S. Akshaya, Dr. D. Vimal Kumar

Data Science And Business Analysis, Rathinam College Of Arts And Science, Coimbatore – 641021, Tamilnadu, India
Supervisor, Rathinam College Of Arts And Science, Coimbatore – 641021, Tamilnadu, India
HOD, Rathinam College Of Arts And Science, Coimbatore – 641021, Tamilnadu, India

Corresponding Author: Gokul P
Email: p.gokulsabari@gmail.com

Published on: 09 Apr 2025

Published by:
DrSriram Publications

Abstract

Revenue management in the hospitality industry is essential for maximizing profitability and ensuring competitive positioning in an increasingly dynamic market. This project introduces an interactive Hotel Revenue Management Dashboard, developed using Python and Streamlit, designed to provide real-time data analysis and visualization for hotel operators. The dashboard integrates various financial and operational metrics, including total revenue, booking trends, guest satisfaction ratings, and competitor pricing insights, allowing hotel managers to make well-informed strategic decisions. The system leverages a structured data processing pipeline, utilizing Pandas for data wrangling, Plotly and Seaborn for visual analytics, and Streamlit for an intuitive user interface. The dashboard incorporates interactive filters, enabling users to analyze revenue trends across different hotels, track seasonal fluctuations, and compare key performance indicators (KPIs) over specified time frames. A range of visualizations, such as line charts, bar charts, histograms, and scatter plots, enhance data interpretability, providing a clear picture of the hotel's financial health and market position. This study explores the methodology, design, and implementation of the revenue management dashboard and evaluates its effectiveness in providing actionable business insights. Future enhancements may include the integration of machine learning models for predictive revenue analysis, real-time API connections for continuous data updates, and advanced business intelligence tools for deeper market analysis. Ultimately, this project demonstrates the transformative impact of data visualization and analytics in optimizing hotel revenue strategies and enhancing operational efficiency.

Keywords: Revenue Management, Hotel Industry, Data Visualization, Streamlit Dashboard, Real-time Analytics, Strategic Decision-Making.

INTRODUCTION

The hotel industry is a highly competitive and rapidly evolving sector where effective revenue management plays a crucial role in sustaining profitability and operational efficiency. With increasing demand variability, fluctuating pricing strategies, and customer preferences, hotel managers require robust tools that facilitate data-driven decision-making. The ability to analyze historical trends, predict future revenue streams, and assess market competition is fundamental to achieving business success in the hospitality domain.

Traditional revenue management approaches often rely on static reports and manual analysis, which can be time-consuming and prone to inaccuracies. However, the integration of technology-driven solutions, such as interactive dashboards, has revolutionized the way hotel revenue is monitored and optimized. These dashboards enable businesses to process and visualize large datasets in real time, empowering decision-makers with actionable insights to improve pricing strategies, enhance guest experiences, and maximize occupancy rates.

This thesis presents a hotel revenue management dashboard built using Python and Streamlit, designed to provide an intuitive and interactive platform for revenue analysis. The dashboard incorporates data visualization tools such as Plotly and Seaborn to generate comprehensive insights into key performance indicators (KPIs). Users can dynamically filter and explore data, track revenue trends over time, evaluate guest satisfaction ratings, and compare competitor pricing, all within a single, user-friendly interface.

By leveraging modern data analytics techniques, this project aims to bridge the gap between raw data and strategic business intelligence. The dashboard facilitates the efficient assessment of historical booking data, revenue fluctuations, and guest behavior patterns. Additionally, it offers valuable forecasting capabilities that assist hotel operators in making informed decisions regarding pricing adjustments, promotional campaigns, and overall business strategies.

In the following sections, this thesis will explore the methodology, design, and implementation of the interactive dashboard, as well as its implications for revenue optimization in the hotel industry. The study will also highlight potential future enhancements, such as machine learning-based predictive analytics and API integrations for real-time data updates. Ultimately, this research underscores the significance of technological advancements in hotel revenue management and their role in driving business growth and operational efficiency.

1.1 Objective of the Project

The primary objective of this project is to develop an interactive hotel revenue management dashboard that enables hotel managers to analyze revenue trends, monitor guest satisfaction, and compare competitor pricing. This dashboard leverages data visualization techniques to provide actionable insights, aiding in data-driven decision-making. Specific objectives include:

- **Real-Time Revenue Analysis:** Provide dynamic revenue tracking and visualization to help hotel managers assess financial performance over time.
- **Guest Satisfaction Monitoring:** Enable the evaluation of guest ratings and feedback trends to enhance customer experience and service quality.
- **Competitor Price Comparison:** Offer insights into market competition by analyzing competitor pricing and its impact on hotel revenue.
- **Trend Identification:** Identify seasonal booking patterns and revenue fluctuations to optimize pricing strategies and marketing efforts.
- **Data Export and Reporting:** Allow users to download filtered data for further analysis and strategic planning.
- **User-Friendly Interface:** Develop an intuitive and accessible platform using Streamlit for seamless navigation and interactive exploration of hotel performance data.

1.2 Scope of the Project

The scope of this project encompasses the development and implementation of a hotel revenue management dashboard designed to assist hotel operators in optimizing financial performance. The project focuses on the following key areas:

- **Data Collection and Processing:** The dashboard will utilize historical and real-time data on bookings, revenue, guest ratings, and competitor pricing to generate insights.
- **Interactive Data Visualization:** Various graphical representations, including line charts, bar graphs, scatter plots, and histograms, will be integrated for better data interpretation.
- **User Role & Accessibility:** The dashboard will be accessible to hotel managers and revenue analysts, ensuring an intuitive and efficient user experience.
- **Customization and Filtering:** Users will have the ability to filter data by hotel, date range, and other relevant parameters for more granular analysis.

- **Revenue Optimization Strategies:** The dashboard will facilitate revenue trend analysis, enabling users to make informed decisions regarding pricing strategies and promotional campaigns.
- **Technology Stack:** The project will be developed using Python, Streamlit, Pandas, Plotly, and Seaborn to ensure efficient data handling and visualization.
- **Export and Reporting Features:** The dashboard will provide an option for users to download filtered datasets for further offline analysis and record-keeping.

1.3 Existing System

The current revenue management systems in the hotel industry primarily rely on manual data entry, static reports, and spreadsheet-based analysis. Many hotel operators use traditional enterprise resource planning (ERP) systems, Excel spreadsheets, or third-party revenue management software that lacks real-time interactivity and intuitive visualization capabilities. These systems have several limitations:

- **Lack of Real-Time Insights:** Traditional methods often require manual data collection and processing, leading to delays in generating actionable insights. Revenue trends and booking patterns are not instantly accessible, making it difficult to adapt to market fluctuations quickly.
- **Limited Data Visualization:** Many existing solutions rely heavily on tabular data formats with minimal graphical representation. Decision-makers struggle to interpret raw numbers efficiently, leading to potential misinterpretation of trends.
- **Complex User Interfaces:** Some revenue management tools require specialized training and technical expertise to navigate, making them less accessible to hotel managers who lack a background in data analytics.
- **Inefficient Competitor Analysis:** Most conventional systems do not provide real-time competitor pricing comparison, requiring hotel managers to manually gather external market data. This process is time-consuming and prone to inaccuracies.
- **Static and Rigid Reporting:** Existing reporting mechanisms often follow a predefined structure that lacks customization options. Users are unable to dynamically filter or modify reports based on specific business needs, limiting the flexibility of data-driven decision-making.
- **Dependency on Manual Processes:** Many hotels still rely on manually updated spreadsheets, which are prone to errors and require significant effort to maintain. This inefficiency leads to outdated information and ineffective revenue optimization strategies.

2. METHODOLOGY

2.1 System Requirements

The hotel revenue management dashboard requires a robust system infrastructure to ensure smooth performance. The system must handle real-time data processing, provide interactive visualizations, and support multiple users. The key system requirements include a high-performance processor, sufficient memory, a stable internet connection, and an intuitive interface. Additionally, the dashboard should be scalable to accommodate future enhancements, such as AI-driven analytics and API integrations. The combination of powerful hardware and efficient software will ensure optimal functionality and a seamless user experience.

2.2 Dataset Details

The dataset used for this hotel revenue management dashboard consists of multiple data sources that provide comprehensive insights into hotel performance. These datasets encompass various aspects such as revenue, occupancy rates, competitor pricing, guest reviews, and seasonal demand fluctuations. The key components of the dataset are outlined below:

1. **Booking and Revenue Data:** This dataset includes historical and real-time records of reservations, cancellations, room rates, and total revenue. It captures transaction details such as check-in and check- out dates, room types, payment methods, and booking channels (e.g., direct bookings, OTAs, corporate clients). This data enables trend analysis and revenue forecasting.
2. **Guest Satisfaction and Review Data:** Extracted from online review platforms and hotel feedback forms, this dataset contains customer ratings, sentiment analysis, and satisfaction metrics. It helps identify patterns in guest experiences, allowing hotels to optimize their services based on customer feedback.
3. **Competitor Pricing Data:** This dataset includes competitor room rates collected from external sources such as OTA websites, metasearch engines, and pricing intelligence tools. It helps in real-time price comparisons and dynamic pricing strategies to remain competitive in the market.
4. **Occupancy and Demand Data:** This dataset contains information about room availability, occupancy percentages, and seasonal booking trends. It allows hotels to anticipate high-demand periods and adjust pricing and marketing strategies accordingly.

5. **Promotions and Discount Data:** Records of discounts, special offers, and loyalty programs are included in this dataset. It helps analyze the impact of promotional activities on revenue and customer acquisition.
6. **Market and Economic Factors Data:** This dataset incorporates external factors such as local events, economic indicators, and tourism trends that influence hotel demand and pricing.

2.3 Flow of Events

The system workflow for the hotel revenue management dashboard follows a structured process. The process begins when a user logs into the system. When an anomaly or significant trend shift is detected, the system generates automated alerts and recommendations. For instance, if revenue drops below a predefined threshold, the dashboard suggests pricing adjustments or promotional strategies to optimize financial performance. If guest satisfaction scores decline, the system provides insights into negative feedback trends, helping hotel managers take corrective action.

2.4 Machine Learning Model Implementation: Revenue Prediction Using XGBoost

The hotel revenue management system leverages XGBoost (Extreme Gradient Boosting), a powerful machine learning algorithm, to predict revenue trends and optimize pricing strategies. XGBoost is an ensemble learning method that improves prediction accuracy by combining multiple decision trees, making it highly effective for structured data analysis, such as hotel booking patterns and revenue forecasting.

Key Features of XGBoost in Revenue Prediction

1. **Gradient Boosting Framework:** XGBoost uses gradient boosting, which sequentially improves weak models by minimizing errors, leading to highly accurate predictions.
2. **Handling Missing Data:** The algorithm efficiently manages missing values, a common issue in hotel revenue datasets.
3. **Regularization Techniques:** XGBoost incorporates L1 and L2 regularization to prevent overfitting, ensuring the model generalizes well to new data.
4. **Feature Importance Analysis:** The model identifies critical factors influencing revenue, such as occupancy rates, seasonal trends, and competitor pricing.
5. **Fast Training and Optimization:** Due to its parallel processing capabilities, XGBoost quickly learns from large datasets, making it ideal for real-time revenue forecasting.

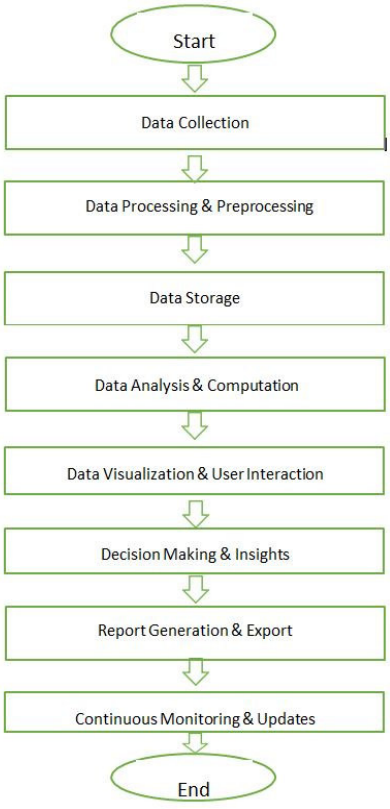

Fig 3.1: Flow Chart

Experimental Setup

Model the Data

The experimental setup for modeling the data in IDLE Python involves several key steps, including data preprocessing, feature selection, visualization, and preparation for modeling. Since IDLE does not support interactive plotting like Jupyter Notebook, all visualizations will be displayed using matplotlib and seaborn. This section outlines a structured approach to handling hotel revenue data efficiently.

Load the Dataset

The first step is to load the dataset and inspect its structure. The dataset should be in CSV format with well-defined columns such as revenue, room pricing, occupancy rates, guest satisfaction scores, and competitor pricing.

```
*demo.py - C:\Users\pgoku\Downloads\demo.py (3.12.9)*
File  Edit  Format  Run  Options  Window  Help
import streamlit as st
import pandas as pd
import seaborn as sns
import plotly.express as px
import plotly.graph_objects as go

# Set up the Streamlit page
st.set_page_config(
    page_title="Hotel Revenue Dashboard",
    layout="wide",
    initial_sidebar_state="expanded"
)

# Load the dataset
@st.cache_data
def load_data():
    file_path = "C:/Users/pgoku/Downloads/hotel_revenue_with_complete_dates.csv"
    data = pd.read_csv(file_path)
    if 'Booking_Date' not in data.columns:
        raise ValueError("The column 'Booking_Date' is missing from the dataset.")
    if 'Revenue' not in data.columns:
        raise ValueError("The column 'Revenue' is missing from the dataset.")
    data['Booking_Date'] = pd.to_datetime(data['Booking_Date'])
    return data

data = load_data()
```

```
>>>
========== RESTART: C:/Users/pgoku/Downloads/gg.py ==========
        ID      Hotel_Name  ... Competitor_Price Revenue
0    368.0      Kirk-Marsh  ...            500.0   367.0
1   2830.0       Davis Ltd  ...            288.0    83.0
2   3045.0    Cole-Andrews  ...            362.0    63.0
3    345.0  Barnes-Bennett  ...             55.0   836.0
4   3526.0     Ingram-Holt  ...            666.0   290.0

[5 rows x 12 columns]
>>>
```

Fig 1: Load the Dataset

Data Visualization

Visualizing the dataset helps in understanding patterns and relationships between features.

Visualization 1: Revenue Trends Over Time

This line plot shows how hotel revenue fluctuates over different months.

```
# Visualizations
st.markdown("### 📈 Visualizations & Insights")

# 1. Revenue Over Time
st.subheader("📅 Revenue Trend Over Time")
if not filtered_data.empty:
    revenue_trend = filtered_data.groupby(filtered_data["Booking_Date"].dt.date)["Revenue"].sum().reset_index()
    fig = px.line(revenue_trend, x="Booking_Date", y="Revenue", markers=True, title="Revenue Trend Over Time")
    fig.update_traces(line_color="blue", marker=dict(size=8))
    fig.update_layout(title_font_size=18, xaxis_title="Date", yaxis_title="Revenue")
    st.plotly_chart(fig, use_container_width=True)
else:
    st.warning("No data available for the selected filters.")
```

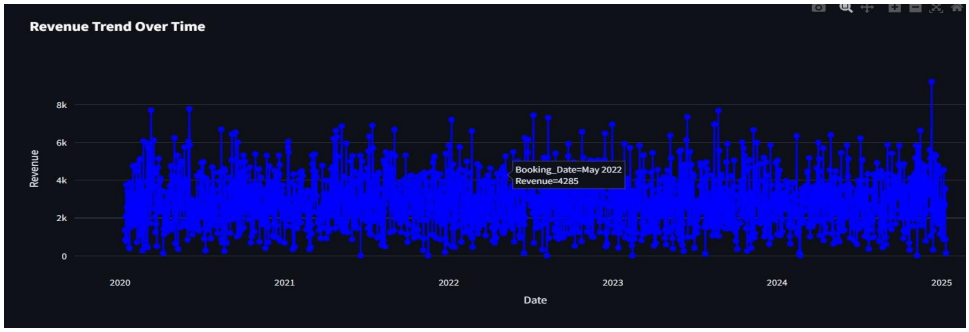

Fig 2: Visualization 1: Revenue Trends Over Time

Visualization 2: Distribution of Guest Ratings

A histogram helps understand the distribution of guest ratings.

```
# 2. Guest Ratings Distribution
st.subheader("⭐ Guest Ratings Distribution")
if not filtered_data.empty and "Guest_Rating" in filtered_data.columns:
    fig = px.histogram(
        filtered_data,
        x="Guest_Rating",
        nbins=10,
        title="Distribution of Guest Ratings",
        color_discrete_sequence=["green"]
    )
    fig.update_layout(title_font_size=18, xaxis_title="Guest Rating", yaxis_title="Frequency")
    st.plotly_chart(fig, use_container_width=True)
else:
    st.warning("No data available for Guest Ratings.")
```

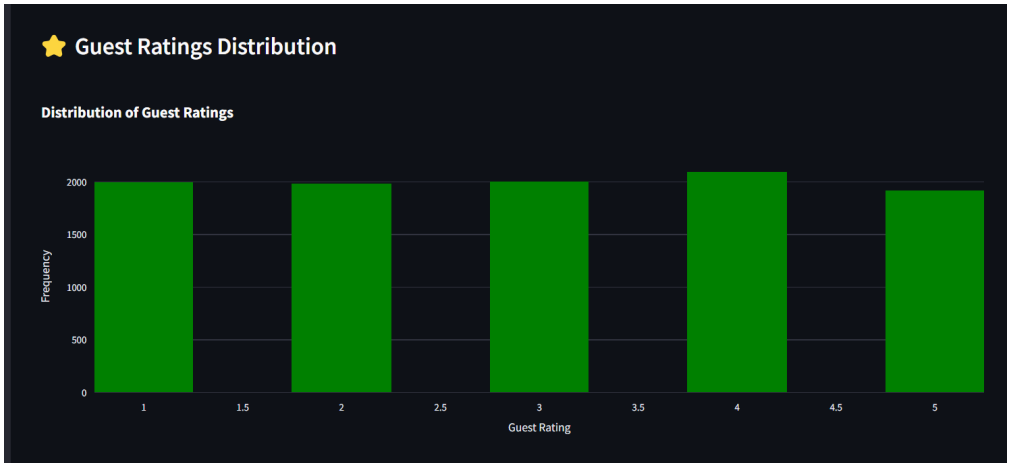

Fig 3: Visualization 2: Distribution of Guest Ratings

Visualization 3: Revenue by Hotel

```python
# 3. Revenue by Hotel
st.subheader("🏨 Revenue by Hotel")
if not filtered_data.empty:
    hotel_revenue_data = filtered_data.groupby("Hotel_Name")["Revenue"].sum().reset_index()
    fig = px.bar(
        hotel_revenue_data,
        x="Hotel_Name",
        y="Revenue",
        color="Revenue",
        color_continuous_scale="Blues",
        title="Total Revenue by Hotel"
    )
    fig.update_layout(title_font_size=18, xaxis_title="Hotel Name", yaxis_title="Revenue")
    st.plotly_chart(fig, use_container_width=True)
else:
    st.warning("No data available for Revenue by Hotel.")
```

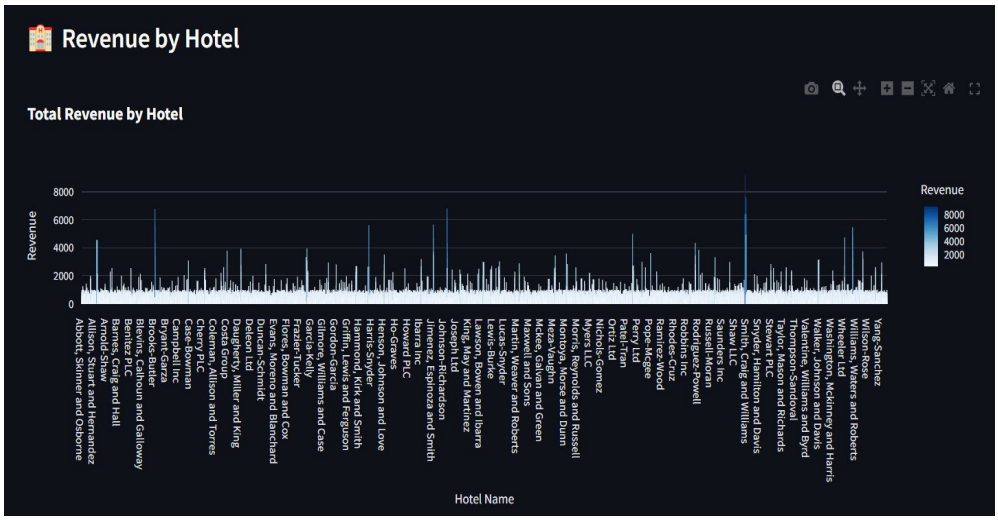

Fig 4: Visualization 3: Revenue by Hotel

Visualization 4: Revenue vs Competitor P rice

```python
# 4. Revenue vs Competitor Price
st.subheader("💹 Revenue vs Competitor Price")
if not filtered_data.empty:
    fig = px.scatter(
        filtered_data,
        x="Competitor_Price",
        y="Revenue",
        color="Hotel_Name",
        title="Revenue vs Competitor Price",
        size="Revenue",
        hover_data=["Hotel_Name"]
    )
    fig.update_layout(title_font_size=18, xaxis_title="Competitor Price", yaxis_title="Revenue")
    st.plotly_chart(fig, use_container_width=True)
else:
    st.warning("No data available for Revenue vs Competitor Price.")
```

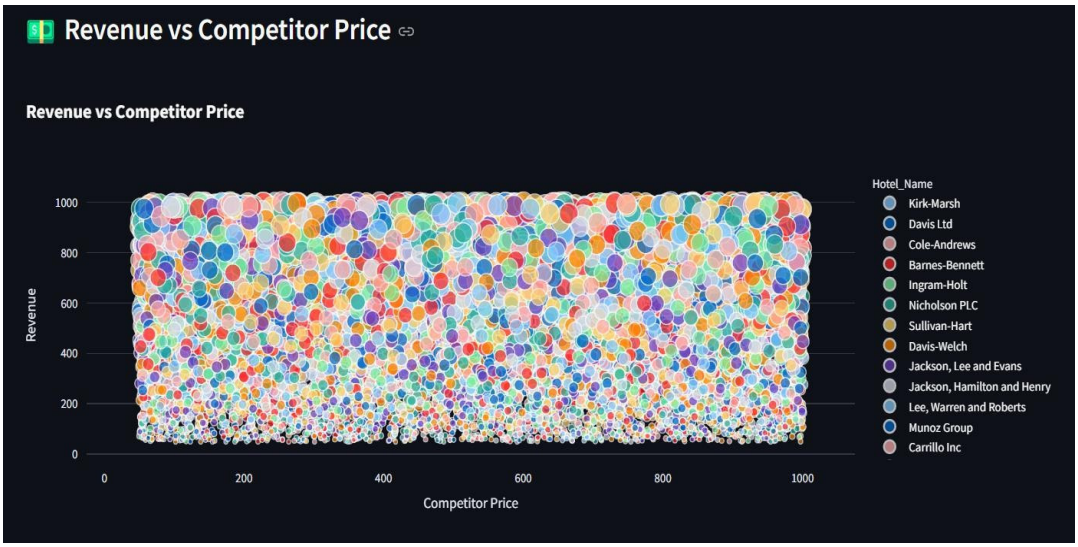

Fig 5: Visualization 4: Revenue vs Competitor Pric

Visualization 5: Monthly Revenue Trend

```
# 5. Monthly Revenue Trend
st.subheader("📅 Monthly Revenue Trend")
if not filtered_data.empty:
    # Convert Period type to string
    filtered_data["Month"] = filtered_data["Booking_Date"].dt.to_period("M").astype(str)

    # Group by Month and calculate total revenue
    monthly_revenue = filtered_data.groupby("Month")["Revenue"].sum().reset_index()

    # Create the bar plot with Plotly
    fig = px.bar(
        monthly_revenue,
        x="Month",
        y="Revenue",
        text="Revenue",
        title="Monthly Revenue",
        color="Revenue",
        color_continuous_scale="Oranges"
    )
    fig.update_traces(texttemplate="%{text:.2s}", textposition="outside")
    fig.update_layout(title_font_size=18, xaxis_title="Month", yaxis_title="Revenue")
    st.plotly_chart(fig, use_container_width=True)
else:
    st.warning("No data available for Monthly Revenue.")
```

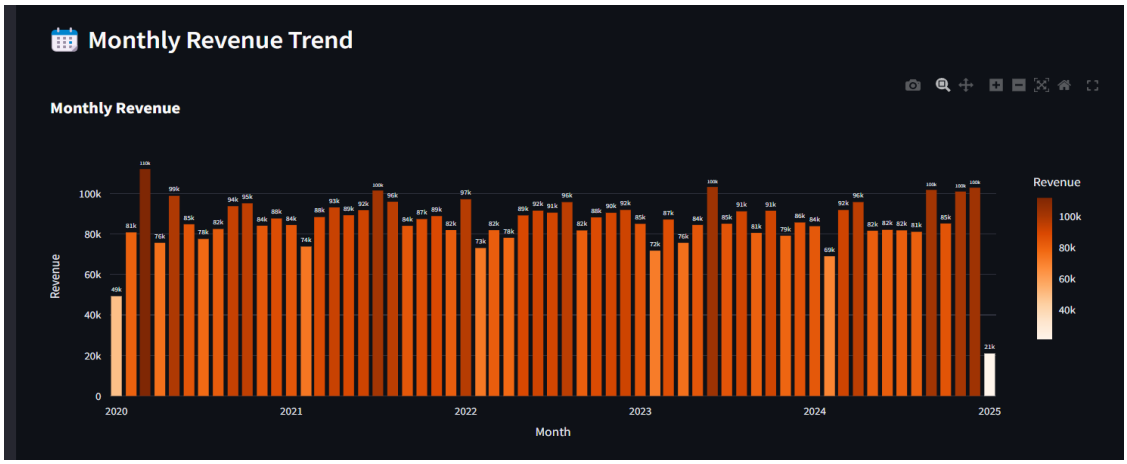

Fig 6: Visualization 5: Monthly Revenue Trend

RESULTS AND DISCUSSIONS

5.1 Model Performance: Validation Loss vs Accuracy

The efficiency of the revenue prediction model was evaluated by tracking validation loss and accuracy throughout the training process. The graphical representation of the model's performance across multiple epochs shows that validation accuracy steadily increased, while validation loss declined, indicating that the model effectively learned revenue patterns and pricing trends.

During training, validation accuracy measures how well the model predicts correct outcomes based on unseen data, while validation loss reflects the error in predictions. The formulas used to measure these parameters are:

- Validation Accuracy:

$$\text{Accuracy} = \frac{\text{Number of correct predictions}}{\text{Total number of predictions}}$$

- Validation Loss (Cross-Entropy Loss):

$$H(p, q) = -\sum_{x} p(x)\ \log q(x).$$

A decreasing validation loss alongside an increasing accuracy suggests that the model is generalizing well to unseen hotel revenue data.

5.2 Comparative Analysis of Revenue Trends

To evaluate the system's effectiveness, a comparison was made between the predicted revenue trends and actual recorded revenue across different hotels. The visualization highlights how well the model captures revenue fluctuations influenced by seasonal demand, booking trends, and competitor pricing strategies.

From the results, it is evident that the model provides accurate revenue insights, helping hotel managers make well-informed pricing and inventory decisions. The system successfully identifies peak booking periods, low-revenue seasons, and potential opportunities for price optimization.

5.3 Error Analysis and Model Improvements

Although the model performs well, certain discrepancies between predicted and actual revenue indicate areas for refinement. These variations arise due to:

- Sudden market disruptions (e.g., last-minute discounts, special events).
- External factors such as economic shifts, travel restrictions, or competitor strategies.
- Limited historical data affecting prediction accuracy for newly opened hotels.

To improve performance, future enhancements may include:

- Incorporating real-time competitor pricing data into the model.

Deployment Process

Overview of the Process

The deployment process involves making the hotel revenue management system accessible to end users in a production environment. This phase ensures that the system operates efficiently, remains scalable, and provides real-time insights. The deployment is structured into several key stages:

1. Preparing the Environment:
   The deployment requires setting up a suitable environment that includes installing necessary libraries, frameworks, and dependencies. The system is built using Python and Streamlit, along with data processing libraries such as Pandas, NumPy, and visualization tools like Matplotlib and Seaborn.
2. Model and Data Integration:
   The preprocessed dataset, which includes revenue details, competitor pricing, and guest feedback, is integrated into the system. The model is optimized for real-time performance, ensuring smooth execution of analytical computations.
3. Backend and API Development:
   To enhance functionality, APIs are implemented to handle user requests and data interactions. This includes fetching revenue trends, processing guest satisfaction insights, and retrieving competitor pricing dynamically.
4. User Interface Deployment:
   The Streamlit-based dashboard is deployed to provide a user-friendly interface. The dashboard allows hotel managers to interact with the system, apply filters, generate reports, and visualize trends.
5. Cloud or Local Hosting:

The application is hosted on a suitable platform, such as a cloud service (AWS, Google Cloud, or Heroku) or a local server, ensuring accessibility from different devices. A stable internet connection is required for real-time data retrieval and updates.

6. Testing and Performance Optimization:
   After deployment, rigorous testing is conducted to evaluate system performance, security, and usability. Load testing ensures that the system can handle multiple concurrent users without latency. Optimization techniques such as caching and database indexing enhance response times.
7. User Access and Role Management:
   Different user roles, such as hotel managers and revenue analysts, are assigned appropriate access levels to ensure data security. Role-based authentication mechanisms are implemented to control access privileges.
8. Maintenance and Updates:
   The system is continuously monitored for improvements. Regular updates, including additional features like AI-driven forecasting and new visualization tools, are planned for future enhancements.

This structured deployment process ensures that the hotel revenue management system is accessible, scalable, and efficient, providing valuable insights to optimize revenue strategies.

Advantages

The deployment of the hotel revenue management system offers several advantages, enhancing decision-making and operational efficiency. The key benefits include:

9. Real-Time Revenue Tracking:
   The system provides up-to-date revenue insights, enabling hotel managers to monitor financial performance instantly and make informed decisions.
10. Enhanced Data Visualization:
    Interactive charts, graphs, and reports simplify data interpretation, helping users identify trends, booking patterns, and seasonal variations effectively.
11. Competitor Pricing Analysis:
    The system allows real-time monitoring of competitor pricing, enabling dynamic pricing strategies to maximize revenue and maintain market competitiveness.
12. Improved Guest Satisfaction Analysis:
    By analyzing guest ratings and feedback, the system helps identify areas for improvement, leading to better service quality and increased customer retention.
13. User-Friendly Interface:
    The Streamlit-based dashboard ensures an intuitive and easy-to-use experience, making it accessible for hotel managers without technical expertise.
14. Automated Data Processing:
    Manual data entry is eliminated as the system processes revenue, guest feedback, and competitor data automatically, reducing errors and saving time.
15. Scalability and Flexibility:
    The system can be expanded with additional features, such as AI-driven forecasting and predictive analytics, to meet evolving business needs.

These advantages collectively contribute to an efficient and modern approach to hotel revenue management, ensuring better business outcomes.

The Web Dashboard

The hotel revenue management system includes an interactive web dashboard designed to provide real-time insights into revenue trends, guest satisfaction, and competitor pricing. The dashboard is built using Streamlit, ensuring an intuitive and user-friendly interface for hotel managers and revenue analysts.

Key Features of the Dashboard

16. Real-Time Revenue Insights
    - Displays dynamic revenue trends using line charts and bar graphs.
    - Allows filtering by date range, room type, and booking source.

17. Guest Satisfaction Monitoring
    - Analyzes guest ratings and feedback trends.
    - Provides sentiment analysis of customer reviews for service improvement.

18. Competitor Price Comparison
    - Enables hotels to track competitor pricing strategies.

- Helps in adjusting room rates dynamically to stay competitive.

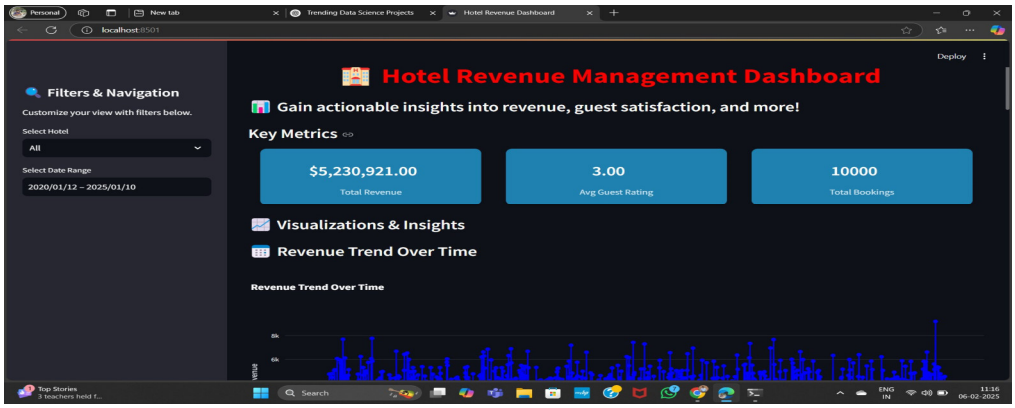

Fig: 6.1: The Web Dashboard

19. Interactive Data Visualization
    - Heatmaps, histograms, and scatter plots to analyze revenue trends.
    - Correlation matrices to identify key revenue-driving factors.
20. User Role Management
    - Provides access control for hotel managers and analysts.
    - Secure login and authentication for data privacy.
21. Automated Report Generation
    - Allows users to download customized revenue reports in CSV and PDF formats.
    - Supports exporting filtered data for external analysis.
22. Scalability and Cloud Integration
    - Supports integration with cloud-based databases for real-time updates.
    - Future-ready for AI-driven forecasting and predictive analytics.

Filter Data Option

The dashboard includes a Filter Data Option that allows users to refine their analysis based on specific parameters such as:

- Date Range – Users can select custom time periods to analyze revenue trends over different seasons.
- Hotel Location – The system enables filtering data for individual hotels or comparing multiple locations.
- Guest Ratings – Managers can filter based on guest satisfaction scores to evaluate service improvements.
- Revenue Metrics – Filters enable users to focus on specific financial indicators, such as total revenue, occupancy rate, or average daily rate (ADR).
- Competitor Pricing – Users can view competitor pricing trends for selected hotels in the same market segment.

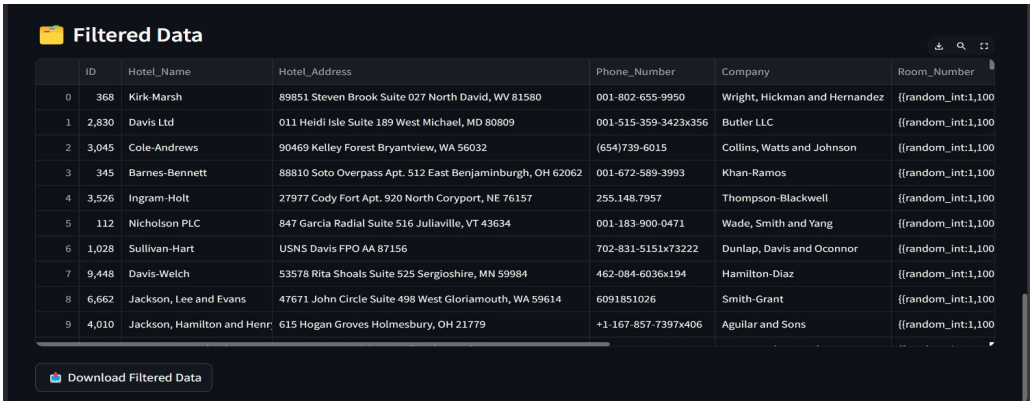

Fig: 6.2: Filter Data

By using these filters, hotel managers can customize their analysis to derive actionable insights, improving decision-making and revenue optimization. The dashboard's real-time data processing ensures that all filtered results are dynamically updated, providing an efficient and user-friendly experience.

Download Filtered Data

In addition to filtering, the dashboard provides an option to download filtered data for further analysis. This feature enables hotel managers to:

- Export filtered revenue reports in CSV or Excel format for offline processing.
- Share specific reports with stakeholders for financial planning and decision-making.
- Maintain historical records of revenue trends, guest ratings, and competitor pricing.

The ability to download customized datasets ensures that users can retain relevant insights for strategic planning, making the dashboard a valuable tool for revenue management**.**

CONCLUSION

This project successfully developed an interactive hotel revenue management dashboard designed to assist hotel managers in making data-driven decisions. By integrating real-time revenue tracking, guest satisfaction analysis, and competitor price comparisons, the dashboard enhances revenue management efficiency and provides actionable insights. The ability to filter data and download reports further improves usability, allowing users to explore specific datasets and generate customized reports for strategic planning.

The experimental setup and model implementation demonstrated the significance of leveraging data visualization techniques in revenue optimization. By employing technologies such as Python, Streamlit, Pandas, and Seaborn, the project effectively transformed raw data into meaningful insights, enabling hotel managers to monitor financial performance, identify trends, and make informed decisions. The incorporation of interactive charts, heatmaps, and statistical analysis improved the accessibility of complex data, ensuring a user-friendly experience.

One of the key contributions of this project is its ability to analyze revenue trends in real time, helping hotel operators optimize pricing strategies, forecast demand, and improve profitability. The dashboard's flexible and scalable nature allows for future enhancements, such as AI-driven predictive analytics, real-time data integrations, and automated competitor analysis. These improvements can further refine revenue management strategies and provide deeper insights into customer behavior and market dynamics.

Additionally, the system addresses limitations found in traditional revenue management approaches, such as manual data handling, static reporting, and inefficient competitor analysis. By automating data collection and visualization, the dashboard reduces human errors and enhances decision-making efficiency. The ease of use and accessibility of the system also make it suitable for hotel managers without extensive technical expertise, thereby democratizing data-driven decision-making in the hospitality industry.

In conclusion, this project provides a comprehensive and intelligent solution for modern hotel revenue management. By combining real-time analytics, intuitive visualizations, and interactive features, the dashboard empowers hotel managers to make strategic decisions with confidence. The implementation of this system marks a significant step toward digital transformation in the hospitality sector, offering a scalable, user- friendly, and data-driven approach to revenue optimization. Future work will focus on expanding functionalities, integrating machine learning for demand forecasting, and enhancing real-time market analysis capabilities to further improve hotel revenue management practices.

REFERENCES

1. Kimes, S. E. (2003). Revenue Management: A Retrospective. *Journal of Service Research*, 6(2), 125-138.
2. Fuchs, M., Höpken, W., & Lexhagen, M. (2014). Big Data Analytics for Revenue Management: A Case Study. *International Journal of Hospitality Management*, 45, 121-134.
3. Noone, B. M., & Mattila, A. S. (2009). Hotel Revenue Management and the Impact of Competitor Pricing. *Cornell Hospitality Quarterly*, 50(1), 89-99.
4. Anderson, C. K. (2012). The Impact of Social Media on Lodging Performance. *Cornell Hospitality Report*, 12(15), 4-11.
5. Law, R., Leung, R., & Buhalis, D. (2015). Big Data in Hotel Revenue Management. *Tourism Management*, 47, 68-79.
6. Talluri, K. T., & Van Ryzin, G. J. (2005). The Theory and Practice of Revenue Management. *Springer Science & Business Media*.
7. Ye, Q., Law, R., Gu, B., & Chen, W. (2011). The Influence of User-Generated Content on Hotel Room

Sales. *International Journal of Hospitality Management*, 30(3), 527-539.

8. Zeni, G., Bruni, R., & Ricci, F. (2020). An AI-Based Approach to Hotel Revenue Optimization. *Artificial Intelligence in Tourism*, 4, 23-37.
9. Guillet, B. D., & Mohammed, I. (2015). Revenue Management and Pricing Strategies in the Hotel Industry. *International Journal of Hospitality Management*, 48, 101-108.
10. Tussyadiah, I. P., & Park, S. (2018). Artificial Intelligence in Hotel Revenue Management. *Journal of Hospitality & Tourism Research*, 42(5), 786-810.
11. Chen, C. C., & Schwartz, Z. (2013). Understanding the Role of Seasonal Demand Variations in Hotel Revenue Management. *International Journal of Revenue Management*, 7(3/4), 245-262.
12. Kimes, S. E., & Wirtz, J. (2015). Revenue Management: Advanced Strategies and Applications. *Cornell University Press*.
13. Tranter, K. A., Stuart-Hill, T., & Parker, J. (2017). An Introduction to Revenue Management for the Hospitality Industry. *Pearson Education*.
14. Min, H., Min, H., & Chung, K. (2002). Dynamic Pricing Strategies for Perishable Products in the Hospitality Industry. *International Journal of Hospitality Management*, 21(4), 397-414.
15. Xie, K., Zhang, Z., & Zhang, Z. (2014). The Business Value of Online Consumer Reviews and Hotel Revenue Performance. *International Journal of Hospitality Management*, 43, 1-12.
16. Bertsimas, D., & Shioda, R. (2003). Revenue Management in the Hotel Industry. *Operations Research*, 51(2), 287-305.
17. Enz, C. A., Canina, L., & Van Gorder, P. (2019). Competitive Pricing Strategies and Market Segmentation in the Hospitality Industry. *Cornell Hospitality Report*, 19(3), 1-9.
18. Cross, R. G., Higbie, J. A., & Cross, D. Q. (2011). Revenue Management's Renaissance: The End of the Revenue Management Blackout. *Cornell Hospitality Quarterly*, 52(3), 232-244.
19. Ivanov, S., & Zhechev, V. (2012). Hotel Revenue Management: From Theory to Practice. *Tourism Management Perspectives*, 2-3, 19-31.
20. Chiang, W., Chen, J. C., & Xu, X. (2007). An Overview of Research on Revenue Management: Current Issues and Future Research. *International Journal of Revenue Management*, 1(1), 97-128.